of the term, but simply the result of local chemical action. The formation is cretaceous. The bluff is capped by calcic carbonate. Beneath are shales containing ferric bisulphide in crystals of pyrites. Below the shale is a soft limestone, containing carbonates of magnesia and alumina. The chemical reactions consequent upon part of the soil being soaked with water after its fall toward the river, have been the decomposition of the pyrites, the production of sulphuric acid, and the attack of the acid on the alkaline carbonates. The heat evolved in the first of these reactions is, of course, very great; in the latter part the violence must be increased by the liberation of carbonic anhydride. All the authenticated disturbances are thus easily explained. Prof. Aughey does not connect them with the earthquake.

Prof. J. L. Campbell, of Washington and Lee University, has been collating and discussing the data for the great meteor which was seen in many parts of Virginia on the afternoon of November 20. He concludes that its height was about 100 miles; but this estimate is merely approximate. Its course seems to have been 8° or 10° west of north. Its explosion appears to have taken place over the south-east corner of Halifax County, about fifteen or twenty miles a little south of west from Clarksville, 100 miles from Richmond, eighty from Lexington, and fifty-five from Raleigh. It was a meteor of unusual size and brilliancy, and detonated loudly when it exploded.

The corner-stone of a building for the accommodation of the Davenport Academy of Natural Sciences was laid on October 4, and is almost the first edifice west of Chicago intended for purely scientific purposes; the building is expected to be ready for occupation this month. The Academy is a young institution, which has grown very rapidly, and has already assumed a prominent position among establishments of this kind in the United States. This is due principally to the excellent character of its *Transactions*, filled with interesting information, and especially rich in subjects relating to American archæology. Part 1 of vol. ii. has been sent us.

If the descriptions are not overdrawn, a remarkably convenient small steam engine has been invented in Philadelphia. It is an oscillating engine, attached to a tank holding about two gallons of water. The boiler is of about a quart capacity; the steam-chest half that size; the whole concern occupies a space of about 10 inches square and 18 high, and weighs 35 pounds. It is designed for use with any sort of light machinery, and is said to be suitable for a variety of domestic work. The details of the contrivance are not yet stated, but assurances are given that it cannot, under any circumstances, explode; that it is as manageable as an ordinary gas burner, since the inventor has succeeded in dispensing with water and steam gauges and automatic floats, so that the whole apparatus is simple, and no skill is required to operate it. The kitchen of the future is expected to contain one of these engines, to chop hash, turn the coffee-mill and the roasting-jack, sift ashes, and mangle the family linen.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

EDINBURGH.—The matriculation returns for the past year have now been completed, and show a considerable increase in the number of students in residence over any former period. The numbers on the register for 1876 were 2,302, for 1877 they amount to 2,560. The students are divided between the several faculties as follows:—In the faculty of arts, 953 students; of theology, 67; of law, 364; and of medicine, 1,176. The ground is now being cleared for the erection of the University Extension Buildings, which, with the aid of the Government grant, will be vigorously proceeded with, and thus furnish the additional accommodation so urgently required for the increasing number of students, and for the fuller development of the teaching resources of the University.

TAUNTON COLLEGE SCHOOL.—A first-class microscope by Smith and Beck, a handsome clock and centre-piece, a purse containing 136*l*., and addresses emblazoned on parchment, from the old boys, the parents, and the friends of the school, have been presented to the Rev. W. Tuckwell, on his leaving Taunton.

FRANCE.—M. Bardoux will propose to the French Parliament, during its present session, to organise, in each department (there are eighty-nine), a high primary school after the model of the École Turgot, one of the municipal schools of Paris. He will also introduce a bill for enlarging the Sorbonne, the traditional head-quarters of the University.

BERLIN.—The professorship of botany, which has been vacant since the death of Alexander Braun last March, is now to be filled by Prof. Eichler, of Kiel, who has accepted a call to this position as well as to the directorship of the Botanical Gardens in Berlin. He enters upon his duties next April. During the *interim* the gardens are under the direction of Prof. Koch.

GÖTTINGEN.—The present attendance at the University is 909, a slight decrease on the past summers. They are divided among the faculties as follows: theology, 86; medicine, 115; law, 275; philosophy, 433. The representation of foreign countries is unusually small, with the exception of America, which supplies a contingent of 27. The corps of instructors, numbering 116, includes 9 in theology, 26 in medicine, 14 in law, and 67 in philosophy and science.

ERLANGEN.—The University is attended at present by 448 students, a slight increase on the number of the past summer. Bavaria contributes 305, the remaining 143 coming from the other parts of Germany and from abroad. Medicine includes 110, pharmacy 56, chemistry and the natural sciences 32, mathematics and physics 10.

SCIENTIFIC SERIALS

THE current number of the *Quarterly Journal of Microscopic Science* commences with Dr. Roberts' address at the Manchester meeting of the British Medical Association on the doctrine of Contagium Vivum and its application to medicine.—Following this is Part 4 of Mr. Archer's *résumé* of recent contributions to our knowledge of "Fresh-water Rhizopoda," including the Rhizopoda, Monothalamia, Monostomata.—Prof. Carl Vogt's account of *Loxosoma* is abstracted, with notes, by Rev. T. Hinks. The genus is confirmed as a Polyzoon, and allied to *Pedicellina*. Its ova and reproductive buds are described, as well as the different organs, in detail.—A paper by Prof. Arthur Boettcher treats of the results arrived at by treating red blood corpuscles with alcoholic solution of corrosive sublimate.—Dr. Klein contributes a paper on the minute anatomy of the epidermis in small-pox of sheep.—The last paper is Prof. Lankester's important notes on the embryology and classification of the animal kingdom; comprising a revision of speculations relative to the origin and significance of the germ-layers. This paper has since been separately published.

Annalen der Physik und Chemie, No. 10.—On the border angle and the expansion of liquids on solid bodies, by M. Quincke.—On the specific heat of vapours and their variations with the temperature, by M. Wiedemann.—Determination of the ratio of the specific heats for air at constant pressure and constant volume by the velocity of sound, by M. Kaiser.—On the internal friction of solid bodies (continued), by M. Schmidt.—On the doctrine of aggregate states, by M. Ritter.—Manometric method of determining the specific gravity of gases, by M. Reeknagel.—On the disaggregation of tin, by the Editor.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, Dec. 13, 1877.—"Experimental Researches on the Electric Discharge with the Chloride of Silver Battery," by Warren De la Rue, M.A., D.C.L., F.R.S., and Hugo W. Müller, Ph.D., F.R.S. Part I.

The paper in question deals mainly with the striking distance between terminals of different forms in air and in other gases at ordinary atmospheric pressures; and in air at reduced pressures short of the partial vacua of the so-called vacuum tubes.

The authors have found that the discharge of the battery, with one or two poles in the form of a point, presents several interesting phenomena which precede the true jump of the spark, and which do not occur with other forms of terminals; for example, discs or spherical surfaces. With 8,040 cells the striking distance between a paraboloidal point, positive, and a disc is about 0·34 in. (8·64 millims.), but there is always a luminous discharge. Very apparent, far beyond the distance measurable by their micrometer-discharger, namely, 1·16 inch (29·5 millims.), as they have before stated.[1]

The current which passes during the luminous discharge which precedes the jump of the true spark is extremely feeble, in comparison with that which takes place after the spark has passed and the voltaic arc has formed ; even when the point and disc are not more distant than ·02 inch beyond the striking distance 0·34 inch for 8,040 elements, it is only $\frac{1}{2864}$th part of it.

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[1] *Proc. Roy. Soc.*, 1876, vol. xxiv. p. 169.

The appearance of the discharge is very different, according as the point is positive or negative ; it is intermittent in both cases, but is much less discontinuous when the point is negative than when it is positive, as can be seen with a microscope having a rotating minor placed in the bend of the body between the objective and eye-piece. The appearances observed are shown in the wood engravings which illustrate the paper.

Between a point and a disc the spark is longest with the point positive, when from 5,000 to 8,000 cells are used ; but for a less number of elements, 1,000 to 3,000, it is longest when the point is negative.

The length of the spark is greatly influenced by the form of the point ; thus with a point in the form of a cone of 20 degrees the striking distance is 0·184 inch with 5,640 cells, and 0·267 inches with 8,040, while with a point approaching a paraboloid in form, and with the same base and of the same height as the cone, it is 0·237 inch with 5,640 cells, and 0·343 inch with 8,040.

The striking distance between a point and a plate is in accordance, very nearly with the hypothesis of this distance, increasing in the direct ratio of the square of the number of elements, at all events up to 8,040 cells, thus [1] :—

Number of cells ...	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000
	in.	in.	in.	in.	in.	in.	in.	in.
Distance observed ...	0·0051	0·0221	0·0554	0·103	0·159	0·222	0·236	0·352
Distance calculated...	0·0055	0·0220	0·0495	0·088	0·1375	0·198	0·2695	0·352

Between plane, spherical, or cylindrical surfaces, the striking distance does not follow this law ; on the contrary, the increase is nearly, but not quite, in the ratio of the number of cells.

	1,000 cells.	8,000 cells.
	in.	in.
Between spherical surfaces	0·0050 ...	0·0810
Plane ,, ,, ...	0·0104 ...	0·0852
Two concentric cylinders	0·0071 ...	0·0991

The striking distance between two paraboloidal points was found to be with—

1,080 cells.	8,040 cells.
in.	in.
0·005	0·401

The nature of the metal used for terminals has, in almost all cases, no influence on the length of the spark, but there is one striking exception, namely, in the case of aluminium ; when an aluminium point is used the spark is longer than with points of all other metals tried, in the ratio of 1·242 to 1.

The length of the spark is different in various gases; for example, air, oxygen, nitrogen, hydrogen, and carbonic acid, and the ratio between the lengths of spark in various gases varies with the forms of the terminals. The length of the spark bears no simple relation either to the density of the gas or its viscosity.[2]

The paper contains an account of a few experiments on the length of spark in air at different pressures, from 141·5 millims. to 760 millims. Between a point and a disk the length of the spark increases nearly, but not quite, in the ratio of the dilatation ; but between two spherical surfaces it increases far more rapidly, and it is possible that at a certain degree of rarefaction the striking distance may be coincident for spherical surfaces and points.

When a strong resistance is interposed in the circuit, 4,000,000 ohms for example, the discharge is completely changed in character ; instead of the ordinary spark and production of the voltaic arc, very brilliant snapping sparks pass between the terminals at more or less rapid intervals, exactly like the sparks of a small Leyden jar. Then pierce a piece of writing with minute holes.

It has been found that an accumulated charge of a condenser of 42·8 microfarads capacity, charged with the potential of 3240 cells, produced neither an elongation nor a contraction of a metallic rod 0·2 inch when suddenly discharged through. This charge deflagrates 10·5 inches of platinum wire 0·0125 inch in diameter.

More dense sparks were obtained with one of App's coils for producing 6-inch sparks when the primary was connected with 1080, 2280, 3480 chloride of silver cells, than when it was used with a zinc-carbon, bichromate of potash battery of six cells producing a current 300 times as great, thus showing the influence of high potentials in inducing secondary currents.

These currents of high potentials have also a marked effect in inducing magnetism, when the actual current is taken into account.

The second part of the paper, which is in course of preparation, will deal with the discharge in rarefied gases, in the so-called vacuum tubes.

Chemical Society, December 20, 1877.—Dr. Gladstone, president, in the chair.—The following papers were read :—On the constitution of the terpenes and of camphor, by Dr. Armstrong.—Communications from the laboratory of the London Institution, by Dr. Armstrong.—On the hydrocarbons from *Pinus sylvestris*, with remarks on the constitution of the terpenes, by Dr. Tilden. The author has examined the terpenes from Russian turpentine oil and *Oleum foliorum pini sylvestris*. He considers that there are probably only three isomerides amongst the natural terpenes, and suggests a formula for these bodies derived from that of diamylene.—On citric acid as a constituent of imperfectly ripe mulberry juice, by Dr. Wright and Mr. Paterson. This juice was found to contain 26·83 grm. of citric acid and 3·26 grm. of potash salts per litre ; the authors point out that it may be valuable as an antiscorbutic, and as a substitute for lime juice.—On cuprous chloride and the absorption of carbonic oxide and hydrochloric acid gas, by J. W. Thomas. The author suggests a ready method of making a solution of cuprous chloride for gas analysis, but finds that although a solution of this salt absorbs carbonic oxide readily, sixty-three per cent. of the gas may be again liberated on neutralising the solution with potash. To avoid such an error he just neutralises the solution of cuprous chloride with ammonia and in this way prepares a solution which introduces into the absorption tube neither free ammonia nor free acid, but which absorbs carbonic oxide with facility. The author has also observed that a saturated solution of ammonic sulphate absorbs hydrochloric acid gas with great readiness, forming an acid salt and ammonic chloride.

Anthropological Institute, December 11, 1877.—Dr. John Evans, D.C.L., F.R.S., president, in the chair.—Dr. James F. N. Wise was elected a member.—Mr. Worthington Smith exhibited some objects from Maiden Bower, and a series of camera lucida drawings of several stone monuments in Wales.—Mr. A. Jukes Browne, F.G.S., exhibited a series of flint flakes, scrapers, and arrow points from Egypt, and read an interesting paper on the subject. He described the geological formation of the country round Helwan about sixteen miles south of Cairo, whence the flints were obtained, and explained the denuding action of the Nile in this locality. He thought that the finding of separate implements in each site pointed to there having been flint manufactories on those spots which, moreover, were near the hot springs. No adzes or celts were found, but fragments of horses' teeth split into long pieces were among the flints. The flints used in the manufacture of these implements were pebbles found on the lower plateau which had been washed down from the hills of eocene limestone above, the upper beds of which abound in siliceous concretions of various sizes.—Mr. Jukes Browne also exhibited some flint implements from a site on the borders of the Fens in Lincolnshire, which appeared to have been a station or manufactory similar to those at Helwan. The president and Mr. Moggeridge made some remarks on the above.—Mr. J. Park Harrison communicated a further report on the "cave-pits" at Cissbury. He said that the galleries belonging to it, and the pits adjoining, appeared to have been used as places of shelter and concealment for some considerable time after they were excavated. No evidence existed at present that they were habitations. One shaft, to which there was access from the cave-pits, was found to have been left unfinished with the horn tools lying where the work had been interrupted. Several small oval pits, the largest only 5 feet long, and 4 feet 6 inches deep, were met with this autumn for the first time in the neighbourhood of the shafts. Among their contents were sling stones and small pieces of flint and fractured rubbing-stone bearing marks of fire, fragments of pottery of various dates, a few flint implements and many flakes ; also three weights formed of chalk (similar to some found in Mr. Tindale's pit) ; a carding-comb, a small iron hook, and three pieces of burnt clay with the impress of sticks on wattles. A few bones of calf, roebuck, pig, and goat, with two or three shells, were the only animal remains. They would appear to have been preserved by the charcoal and charred matter in contact with them. If the little pits were graves they would appear to have been used for secondary interments, or been otherwise disturbed. The absence of human bones might be due to atmospheric influence, as in many other cases of burial by inhumation. There was black mould at the bottom of all the little pits. Coarse potsherds, flint implements, and burnt pebbles were also found in the neighbourhood of the small pits near the surface, and may possibly mark the spots where flint-workers of an earlier period were interred. A discussion followed in which several members took part.

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[1] *Proc. Roy. Soc.*, 1876, vol. xxiv. p. 167.

[2] *Proc. Roy. Soc.*, vol. xxvi. p. 227.

Institution of Civil Engineers, December 18, 1877.—Annual General Meeting.—Mr. George Robert Stephenson, president, in the chair.—The numbers of the several classes of members on November 30, 1877, were:—Honorary members, 16; members, 925; associates, 1,670; and students, 448; together, 3,059, as against 2,844 at the same date last year, showing an increase at the rate of about 7½ per cent. The income proper for the year had amounted to 9,903*l.* 5*s.* 3*d.*, the life compositions and admission fees and building fund (all regarded as capital), to 2,113*l.* 13*s.*, and the dividends on trust funds to 462*l.* 16*s.* 6*d.* The general expenditure had reached 10,278*l.* 2*s.*, and the payments on account of trusts were 486*l.* 8*s.* 5*d.* The disbursements were thus 374*l.* 16*s.* 9*d.* in excess of the income. The funded property (including the cash balance) belonging to or under the control of the Institution, was now 38,773*l.* 4*s.* 11*d.*—Mr. John Frederic Bateman, F.R.S., was elected president.

Victoria (Philosophical) Institute, January 7.—Mr. C. Brooke, F.R.S., in the chair.—It was announced that exactly one hundred members had joined during the past year.—A paper on limitations in nature was read by Mr. S. R. Pattison, F.G.S.

EDINBURGH

Royal Society, December 17, 1877.—Sir William Thomson, president, in the chair.—Mr. Alexander Buchan read the report of the deputation from the Society to Upsala to assist in celebrating the four hundredth anniversary of the University of Upsala.—Mr. J. B. Hannay then read a paper on a new method of determining the cohesion of liquids by the size of its normal drop, which he considered was that obtained by allowing the drops to succeed one another as rapidly as possible. He found that the weight of the drop of liquid dropping from a column of the same liquid increases at the rate at which the drops follow one another. This, he thought, was due (1) to the fact that the rate of flow of liquid through the neck of the drop was faster when drops succeeded rapidly, and (2) because the flow lasted for a longer time He found also that cohesion decreases with rise of temperature, but rather quicker than the density.

PARIS

Academy of Sciences, December 31, 1877.—M. Peligot in the chair.—M. Faye presented the *Annuaire du Bureau des Longitudes* for 1878.—The following papers were read:—On the constitution of the solar surface and on photography regarded as a means of discovery in physical astronomy, by M. Janssen. Photography has two advantages over optical observation. If the time of exposure be accurately determined, so as to prevent superposition, or what may be called *photographic irradiation*, the true relations of luminous intensity of the object are expressed. Further, when the luminous action is very short the photographic spectrum is reduced to a narrow band near G; thus very tolerable photographic images of the sun may be had with simple lenses of long focus, and chemical achromatism is much more easily realised than optical. M. Janssen has so arranged that the time of luminous action can be reduced to $\frac{1}{3000}$ of a second in summer. The images are more latent and require slow development, &c. But they throw new light, especially on the solar granulations, which are found more or less of spherical form; the irregular grains are made up of small spherical elements. The state resembles that of our clouds. These spherical elements and their distribution probably result from a breaking up by gaseous currents. The luminous power of the sun, then, resides chiefly in a small number of points of its surface, and the spots are not the principal element of the variations that star undergoes.—Constitution and brecciform structure of the meteoric iron of Santa Catharina (Brazil); deductions from its characters, concerning the history of meteoritic rocks, and especially the habitual association of carbon with sulphide of iron, by M. Daubrée. The association referred to may be explained by the action of sulphide of carbon on iron. If an iron bar be thus treated at a red temperature, it gets coated with a crystalline substance which has the characters of pyrrhotine.—On the order of appearance of the first vessels in shoots of *Fœniculum vulgare* and *dulce*, by M. Trécul.—Note on waves and eddies of various kinds in a canal whose current is alternately intercepted and renewed, and in which the depth can be varied, by M. de Caligny.—On the condensation of gases supposed incoercible, by M. Cailletet. Pure dry nitrogen, compressed to 200 atmospheres at + 13°, then suddenly expanded, condenses distinctly in small droplets; The liquid retires from the walls to the centre. Pure hydrogen compressed to 280 atmospheres and expanded, gave momentarily, a very fine mist. Air was also liquefied by a direct experiment. M. Berthelot corroborated M. Cailletet's account.—M. De Lesseps announced that the *personnel* of the first scientific and hospital station of the International African Association had reached Zanzibar. They had met Stanley and got useful advice from him.—On a storm which occurred over the south part of the Suez Canal on the night of October 23–24. In a few hours an artificial lake of about five million cubic metres was formed on the west side of the canal by the rains.—Kinematics and dynamics of current waves on a liquid spheroid; application to the evolution of the elliptic protuberance about a spheroid deformed by attraction of a distant star, by M. Guyon.—On a new experiment on liquefaction of oxygen, by M. Pictet. The oxygen jet in the electric light showed a white central part (of liquid or even solid elements) and an exterior blue part, indicating return to the gaseous state.—On a note by M. Boussinesq on conditions with limits in the problem of elastic plates, by M. Levy.—On a theorem of M. Villarceau; remarks and consequences, by M. Gilbert.—On a new kind of bird of nocturnal prey from Madagascar, by M. Milne-Edwards. This belongs to the same zoological type as the white owls, but has osteological peculiarities.—The peripheric organs of the sense of space, by M. Cyon. Having shown that there are intimate relations between the semicircular canals and the centres of innervation of the muscles of the eye, he considers that sensations caused by excitation (through the otoliths) of the nerve terminations in the ampullæ of these canals, through movements of the head, serve to form our notions of the three dimensions of space.—On the evolution of red corpuscles in the blood of superior animals, viviparous vertebrates, by M. Hayem. The red corpuscles are developed from small, colourless, delicate, very alterable elements termed *hæmatoblasts*.—Experiments proving that there is during life a figured ferment in typhoid human blood, by M. Feltz.—On the cause of spontaneous alteration of eggs; reply to a reclamation of M. Gayon, by MM. Bechamp and Eustache.

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